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**TITLE:** En Route Care in Confined Spaces: Impact of Transport, Immobilization Practices, Space Constraints, and Medical Awareness Enhancements

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## 1. INTRODUCTION:

This group of research projects was designed to look at various aspects of transport, immobilization, optimal physical space, ergonomics, and enhancement of medical awareness. Outcomes of the project will provide significant information and tools that can be used toward increasing a patient's safety, providing more effective patient care, reducing patient and medic discomfort, and the development of vibration mitigation systems.

## 2. KEYWORDS:

paramedic, vibration, ergonomics, en route care, posture, critical care tasks, workspace, pressure points, immobilization, litter, patient handling

## 3. OVERALL PROJECT SUMMARY:

<b>Project 1: Impact of Transport Forces and Immobilization Practices on Patient Physiology</b>  (1) Evaluate the effect of patient weight as a factor on supine biodynamic response for board verses no board  (2) Quantify forces/motions during patient handling such as litter dropping and litter loading/unloading  (3) Evaluate effects of patient strapping protocols and tension applied on supine biodynamic response  (4) Determine the transmitted forces and pressure points on the body during transport  (5) Refine best practices of patient en route care management	<p>The contract necessary for the model development and data analysis portions to be performed by extramural partner ActiBioMotion was approved on 25 SEP 2017. Patient weight research protocol was written and is currently in review by the PI and ActiBioMotion. All CITI training documentation, conflict of interest, and curriculum vitae have been collected for all study personnel. Subject recruitment materials, questionnaires, informed consent, safety, and device documents for the first two protocols are currently under development.</p> <p>Draft of patient handling protocol has been written and is currently under review with a mechanical engineer.</p> <p>Two protocols still need to be written and submitted.</p> <p>A project kickoff meeting was held with the members of ActiBioMotion.</p> <p>The team intends to work concurrently on subprojects 1 and 2 to bring Project 1 back onto the schedule reported in the SOW of the original proposal.</p>
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<p><u>Study Design:</u> Healthy human subjects will act as simulated patients, and be subjected to vibration and shock inputs while various factors are tested against common procedures. Mathematical models will be developed.</p>	
<p><b>Project 2: Optimal Physical Space for En Route Care: Provider Postures and Health</b></p> <ul style="list-style-type: none"> <li>(1) Administer survey of En Route Care providers regarding posture</li> <li>(2) Perform litter loading/unloading assessment focused on Medic posture</li> <li>(3) Evaluate the ergonomics of postures assumed during En Route Critical Care (ERCC) tasks</li> <li>(4) Define and test countermeasures for awkward postures</li> </ul> <p>En Route Care providers will perform ERCC tasks in the confined space of common medical interiors. Postures assumed by the providers, and related health complaints, will be modeled. Countermeasures will be defined.</p>	<p>Test plan for data collection using the posture survey has been written.</p> <p>The survey for this test plan has been drafted and revised by the Site/Project PI, Rachel Kinsler.</p> <p>Identification of test participant populations is in progress.</p> <p>Litter loading protocol has been drafted and is currently in review with the PI.</p> <p>Two more protocols to be written and submitted.</p> <p>The team intends to work concurrently on subprojects 1 and 2 to bring Project 2 back onto the schedule reported in the SOW of the original proposal.</p>
<p><b>Project 3: Medical Awareness Enhancements during Transport</b></p> <ul style="list-style-type: none"> <li>(1) Examine feasibility of incorporating medical device audio alarms with aircraft communications</li> </ul>	<p>The team is working on connections between this ICS and medical monitoring devices from the standard medical equipment set. Test plan is being written.</p> <p>One test plan and four protocols need to be written and submitted.</p> <p>The team intends to work concurrently on subprojects 1 and 2 to bring Project 3 back onto the schedule reported</p>

<p>(2) Perform human factors evaluation of the Transport Telemedicine System (TTS)</p> <p>(3) Evaluate impact of TTS on Flight Paramedic's administration of Critical Care tasks</p> <p>(4) Incorporate hands-free documentation procedures using TTS while performing medical tasks</p> <p>(5) Evaluate quality of patient data collected by Paramedics with TTS</p>	<p>in the SOW of the original proposal. This project may warrant revision of subprojects to prevent duplication of effort with other funded projects. The Principal Investigator will consult with the Science Officer for guidance.</p>
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#### **4. KEY RESEARCH ACCOMPLISHMENTS:**

Nothing to report.

#### **5. CONCLUSION:**

These projects described above will impact military health care by (1) developing guidelines that can reduce secondary damages to the patients during transport; (2) creating assessment tools to develop better patient vibration mitigation technologies and more effective patient transport systems; (3) providing recommendations for countermeasures to reduce the impact of awkward postures and loading procedures assumed by care providers; and (4) capturing critical patient data in the medical evacuation environment without compromising medical provider administration of critical care tasks. These goals complement on-going DoD areas of research into the effects of the transport environment on patients and care providers, telemedicine, far forward documentation of patient conditions and interventions, and enhanced medical monitoring.

#### **Future Plans:**

##### **Project 1**

The patient weight and handling research protocols will be reviewed by the PI and ActiBioMotion. The protocols will then be submitted to USAARL's Regulatory Compliance Office for IRB submission and approval. All CITI training documentation, conflict of interest, and curriculum vitae have been collected for all study personnel. Subject recruitment materials, questionnaires, informed consent, safety, and device documents for the first two protocols are currently under development. The last two protocols will be drafted. Data collection will begin in the next calendar for the two protocols.

## **Project 2**

The test plan for data collection using the posture survey will be reviewed by the PI and finalized for submission to USAARL's Regulatory Compliance Office. The survey for this test plan will be finalized and submitted with the test plan. Identification of test participant populations will continue. Litter loading protocol will be reviewed by the PI and finalized for submission to USAARL's Regulatory Compliance Office. The last two protocols will be drafted. Data collection will begin under the test plan and the first protocol.

## **Project 3**

One test plan to test efficacy of connections between this ICS and medical monitoring devices from the standard medical equipment set will be completed.

### **6. PUBLICATIONS, ABSTRACTS, AND PRESENTATIONS:**

Nothing to report.

### **7. INVENTIONS, PATENTS AND LICENSES:**

Nothing to report.

### **8. REPORTABLE OUTCOMES:**

Nothing to report.

### **9. OTHER ACHIEVEMENTS:**

Nothing to report.

### **10. REFERENCES:**

#### **Project 1 References**

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### **Project 3 References**

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## **11. APPENDICES:**

None.



# En Route Care in Confined Spaces: Impact of Transport, Immobilization Practices, Space Constraints and Medical Awareness Enhancements

## DM167047 Joint En Route Care Award - Intramural

PI: Rachel Kinsler

Org: U.S. Army Aeromedical Research Laboratory

Award Amount: \$3,750K

- Study/Product Aim(s)**
- Evaluate the effect of patient weight as a factor under two immobilization conditions including litter with no backboard and litter with board.
  - Quantify forces/motions during patient handling to include litter dropping and loading/unloading.
  - Evaluate effects of patient strapping protocols and the amount of tension applied using current strapping protocol.
  - Determine the transmitted forces and pressure points on the body during transport. Forces transmitted to the supine human body under whole-body vibration and repeated shock will be quantified.
  - Refine best practices of patient en route care management to include immobilization and strapping procedures.
  - Define countermeasures for awkward postures in the form of posture changes, patient positioning or litter pan height adjustment.
  - Evaluate impact of TTS on Flight Paramedic's administration of En Route Critical Care tasks.
  - Incorporate hands-free documentation procedures using TTS while performing En Route Critical Care tasks.
  - Evaluate quality of patient data collected by Paramedics with TTS.

### Approach

Plans will be written for each sub-project. Volunteers will be used for data collection. The team will use USAARL's research JUH-60A for aircraft data collection.

## Timeline and Cost

Activities	CY	16	17	18	19	20
Develop protocols and test plans for projects 1-3 subprojects 1 and 2.						
Develop protocols for projects 1-3 subprojects 3 and 4. Complete data collection subprojects 1, projects 1-3.						
Complete data collection subprojects 2-3, projects 1-3. Analyze collected data.						
Complete data collection subprojects 4, projects 1-3. Conduct data analysis and reporting.						
Estimated Budget (\$3.75M)		\$750K	\$750K	\$750K	\$750K	\$750K

Updated: 10 NOV 2017



Survey has been written to collect data from U.S. Army medical personnel on awkward posture and injuries caused by these postures while performing medical tasks; team working to identify subject populations/units.

### Goals/Milestones (Example)

- CY16 Goal** – Protocol writing
- ☒ Draft protocols for all sub-project 1 tasks
- CY17 Goals** – Protocol writing and approval
- ☐ Submit all subtask protocols for approval
  - ☐ Complete data collection for all subtask 1s
- CY18 Goal** – Data collection and analysis
- ☐ Complete data collection for all subtasks 2-3
  - ☐ Analyze collected data
- CY19 Goal** – Data collection and analysis
- ☐ Complete data collection for all subtasks 4
  - ☐ Analyze collected data
- CY20 Goal** – Data reporting
- ☐ Analyze collected data
  - ☐ Report findings

### Comments/Challenges/Issues/Concerns

- Nothing at this time.

### Budget Expenditure to Date

Projected Expenditure: \$750K

Actual Expenditure: \$750K